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THE AGE COMPOSITION OF KING SALMON CAUGHT ON SPORT FISHING GEAR IN SOUTHEASTERN ALASKA

By:

Gary Finger,
Division of Biological Research
Juneau, Alaska

Robert Armstrong
Division of Sport Fish
Juneau, Alaska

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THE AGE COMPOSITION OF KING SALMON CAUGHT ON SPORT FISHING GEAR IN SOUTHEASTERN ALASKA[1]

Gary Finger, Fishery Biologist
Alaska Department of Fish and Game
Division of Biological Research
Juneau, Alaska

Robert Armstrong, Fishery Biologist
Alaska Department of Fish and Game
Division of Sport Fish
Juneau, Alaska

INTRODUCTION

This study was part of a complex sampling program, beginning in 1959 and lasting through 1961, to evaluate the catch of king salmon (Oncorhynchus tshawytscha) by sport fishing gear in Southeastern Alaska. Of the various fishery dependent variables and biolobical factors investigated, only the age composition of the catch is presented in this report.[2]

The ocean age groups of king salmon present in the fisheries of the Juneau and Ketchikan areas are of primary concern in this analysis. The age information is presented by area, month, sex, length and the flesh color of the fish.

The age samples were derived from fish caught by sport fishermen and by commercial fishermen utilizing sport fishing gear (both tackle and boats).

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[1]This investigation was conducted with Federal Aid in Fish Restoration Funds under Project F-5-R-1 (1959-1960); F-5-R-2 (1960-1961) and F-5-R-3 (1961-1962).

[2]For an analysis of the other variables investigated see Finger and Armstrong. 1965. Fishery and Biological characteristics of Salmon Caught by Sport Gear in Southeastern Alaska. Alaska Department of Fish and Game Informational Leaflet number 57.

OBJECTIVES

The following objectives were investigated in this study:

1. To determine the age composition of king salmon caught on sport fishing gear by the method of scale reading.

2. To determine the sex ratio of the various age groups.

3. To determine the differences between age groups in relationship to fish flesh color.

4. To compare length frequencies by age groups.

PROCEDURE

The sampling was conducted in the two main fishing areas in Southeastern Alaska, Ketchikan and Juneau. The fishermen were contacted at the various boat landings near the two cities. Two or three men were stationed in each town to collect the needed information.

No set pattern was made for the taking of scales. The men were instructed to take samples whenever possible. From each king sampled a group of scales was taken from an area below the posterior margin of the dorsal fin and just above the lateral line. The scales were then placed in a scale book and the necessary information recorded therein.

The age determinations were carried out by means of an Eberbach Micro-projector. To facilitate this examination the scales were cleaned in water and detergent, then placed on a gum card and pressed into plastic. Each plastic card contained thirty scale samples, one or two selected scales from each fish.

The fish were also sampled for total length (mm), weight (lbs.), flesh color (red or white) and sex. These variables will be considered only in relationship to those scales acceptable as readable in this report.

FINDINGS

Scale samples were obtained from 3,230 king salmon in the Juneau and Ketchikan areas during the 1960 and 1961 fishing seasons (including salmon derbies) and in the 1959 Juneau salmon derby. In the aging of these scales, 568 or 18 percent of the 3,230 samples were eliminated for one of the following two reasons: (1) the markings on the scales were not definite enough to provide accurate age determinations or (2) they were regenerated scales, which means that an indefinite portion of the fish's life history record had been obliterated by some accident to the scale. In this discard group 293 scales were regenerated and 275 were of questionable age.

Freshwater Age

It was found that the freshwater age of the sport caught king salmon could not be accurately determined and was therefore eliminated from the final data. General observations indicated that the majority of the kings spent one winter in freshwater (I+ age) while some migrated out as fry (0+ age) and some spent two winters in the stream (II+ age).

Saltwater Age

In most cases the number of winters in saltwater were easily determined. All ages stated will refer to the number of winter checks (annuli) received while the fish was in saltwater. To obtain the most probable total age add two years to all ages stated (one year for freshwater and the extra year for the year not yet completed). For example, a three-year ocean age king (hereafter referred to as .3 age) might be called a five-year old, i.e., one winter in freshwater and three winters in saltwater making it a four-year old salmon in its fifth year.

Age Composition

Six-ocean age classes were found to exist among the king salmon caught by sport fishing methods in the Juneau and Ketchikan areas. The .3 age group made up 50 percent of the total catch for the combined Juneau and Ketchikan areas (Table 1). The .2 aged kings were second in abundance (31%) with the .4 age fish consisting of 18 percent of the total catch. The one, five and six annulus groups entered the fishery in small numbers.

In general, the age classes for the two areas were similar with a few exceptions. The Ketchikan area had a few more .2 age fish (35%) and a few less .3 age fish (44%) than the Juneau area with 29 percent and 52 percent respectively. These differences were the result of differences between sampling years in both Juneau and Ketchikan with both areas showing a change in the distribution of fish in the .2 and .3 age groups in the two years they were sampled.

Age Composition by Month

As seen from Table 2, the percentage of .4 aged salmon decreased as the season progressed. In general, the local spawning run of king salmon had passed the fishery by mid-June. The age study analysis substantiated this finding by showing the .4 age fish entering the fishery in the largest numbers during the months of May and June. The majority of these .4 aged fish were probably sexually mature fish on their way to local spawning grounds.

The .2 aged kings increased in numbers as the season progressed. This condition probably indicated that the majority of these fish were immature salmon moving into the area to feed after the spawning run had passed the fishery.

TABLE 1. OCEAN AGE COMPOSITION OF THE SPORT GEAR CAUGHT KING SALMON IN THE KETCHIKAN AND JUNEAU AREAS FOR 1960 AND 1961.

Area	Year	OCEAN AGE												
		.1		.2		.3		.4		.5		.6		Total
		No. Fish	%	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish
Ketchikan	1960	2	1	28	19	82	54	35	23	4	3	0	0	151
	1961	5	2	112	46	91	37	35	14	1	0	0	0	244
	Total	7	2	140	35	173	44	70	18	5	1	0	0	395
Juneau	1960	4	0	293	36	377	46	147	18	2	0	2	0	825
	1961	5	1	110	20	332	61	95	17	7	1	0	0	549
	Total	9	1	403	29	709	52	242	18	9	1	2	0	1374
TOTALS	1960	6	1	321	33	459	47	182	19	6	1	2	0	976
	1961	10	1	222	28	423	53	130	16	8	1	0	0	793
	Total	16	1	543	31	882	50	312	18	14	1	2	0	1769

TABLE 2. THE OCEAN AGE COMPOSITION BY MONTH FOR THE COMBINED KETCHIKAN AND JUNEAU AREAS IN 1960 AND 1961.

Year	Month	Ocean Age												
		.1		.2		.3		.4		.5		.6		Total
		No. Fish	%	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish
1960	May	--	--	39	17	91	40	96	42	1	1	--	--	227
	June	3	1	80	28	154	53	49	17	2	.1	2	.1	290
	July	5	1	140	41	167	48	33	10	--	--	--	--	345
	August	1	1	146	62	83	35	4	2	--	--	--	--	234
	Total	9	1	405	37	495	45	182	17	3	0	2	0	1096
1961	May	--	--	12	6	114	56	71	35	7	3	--	--	204
	June	1	1	29	14	129	63	43	21	2	1	--	--	204
	July	5	2	69	30	143	62	12	5	--	--	--	--	229
	August	1	2	28	44	28	44	4	6	2	3	--	--	63
	Total	7	1	138	20	414	59	130	19	11	2	--	--	700

The .3 aged kings did not exhibit any of the above patterns, but remained in good abundance throughout the entire season, declining somewhat as the season progressed. This age group probably consisted of a mixture of sexually mature fish and feeders early in the season with mostly feeders in July and August.

This general pattern and age class abundance was found throughout the fishing season in both the Juneau and Ketchikan areas.

Age Composition by Sex and Month

Both sampling years for the combined Juneau and Ketchikan areas showed a higher percentage of .2 old males over females taken in the month of May. This was also true for the month of June in 1961 (Tables 3 and 4). This finding probably indicated that a considerable number of these fish were precocious males (jacks) coming in with the spawning run. It has also been found that many .1 aged jacks that escape the fishery also enter the rivers each year to spawn (Anonymous, 1957). This tendency of male king salmon to reach sexual maturity at an early age (.1 and .2) and enter the local spawning rivers may account for the percentage increase of females over males in the older age groups and in the .2 age group later in the summer that are harvested by the sport fishing methods.

Flesh Color

Two flesh color variations (red and white) exist among the Alaska king salmon with the red flesh color, a more desirable sport and market product, being more valuable to the fishermen. When possible the flesh color of the kings sampled was recorded. Analysis[1] showed that no differences in length existed between the red and white fleshed fish when the dominate age classes (.2, .3 and .4) were combined; but when analysed by the separate age classes both the .2 and .3 aged fish displayed a greater mean length of white fleshed kings over the reds. There were no significant length differences in the .4 age group. Table 5 lists the mean lengths and 95 percent confidence limits by age group.

The mean lengths by flesh color for the combined and the different age groups were further analyzed for possible sex differences. No significant differences were found in either the combined age,.2 or .4 age groups, i.e.,the white fleshed males and females were not significantly larger than the red fleshed males and females or when compared to each other. In the .3 age group, however, the white females were significantly larger than the red females. No differences were found between the .3 age red and white males in mean lengths.

The reason for the larger .3 age white females over the red-fleshed females and the larger white-fleshed fish (regardless of sex differences) in the .2 and .3 age groups was not apparent and

[1]Tukey's t-test for comparison of two means when sample sizes are different. Tested at the 0.5 level of significance.

TABLE 3. THE COMBINED JUNEAU AND KETCHIKAN OCEAN AGE COMPOSITION BY SEX AND MONTH FOR 1960.

Month	Ocean Age					
	.1	.2	.3	.4	.5	Total
	M/F*	M/F	M/F	M/F	M/F	M/F
Numbers of Fish						
May	--	26/5	34/37	24/48	1/0	85/90
June	0/2	21/22	27/47	13/20	1/0	62/91
July	4/5	23/26	18/32	1/17	---	46/70
August	0/1	20/33	14/24	---	---	34/58
Total	4/8	90/86	93/140	38/85	2/0	227/319
Percentage of Fish						
May	--	84/16	48/52	33/67	---	49/51
June	--	49/51	36/64	39/61	---	41/59
July	--	47/53	36/64	6/94	---	40/60
August	--	38/62	37/63	--	---	37/63
Total	--	51/49	40/60	31/69	---	42/58

* Male/female ratio.

TABLE 4. THE COMBINED JUNEAU AND KETCHIKAN OCEAN AGE COMPOSITION BY SEX AND MONTH FOR 1961.

Month	Ocean Age					
	.1	.2	.3	.4	.5	Total
	M/F*	M/F	M/F	M/F	M/F	M/F
Numbers of Fish						
May	0/0	6/2	46/35	21/32	2/3	75/72
June	0/1	12/4	30/35	13/18	0/2	55/60
July	2/1	19/21	18/52	4/3	1/0	41/77
August	0/0	1/4	3/4	0/0	0/0	4/8
TOTALS	2/2	35/31	97/126	38/53	3/5	175/217
Percentage Fish						
May	--	75/25	57/43	40/60	--	51/49
June	--	75/25	46/54	42/58	--	48/52
July	--	47/53	26/74	--	--	35/65
August	--	--	--	--	--	--
TOTALS	--	53/47	43/57	42/58	--	47/53

* Male/female ratio

TABLE 5. MEAN LENGTH OF SOUTHEASTERN ALASKA KING SALMON BY FLESH COLOR AND OCEAN AGE IN 1960 AND 1961*

Age	Flesh Color	Mean Length in cms. ($\bar{X}$)	95% Confidence Interval	Sample Size	Significance**
.2	Red	66.37	$65.59 < \bar{X} < 67.15$	270	White > Red
	White	68.00	$67.05 < \bar{X} < 68.95$	151	
.3	Red	79.94	$79.09 < \bar{X} < 80.79$	520	White > Red
	White	82.91	$81.44 < \bar{X} < 84.38$	235	
.4	Red	94.92	$93.18 < \bar{X} < 96.66$	157	no difference
	White	95.39	$92.93 < \bar{X} < 97.85$	45	
Combined ages	Red	78.56	$77.73 < \bar{X} < 79.39$	947	no difference
	White	78.99	$77.88 < \bar{X} < 80.10$	431	

* includes Salmon Derby data

** Tukey's t-test for unequal sample size, .05 level of significance.

could well have been only the result of the variations in sampling.

Mean Length by Month and Age

In computing the mean length of king salmon by month and age for the larger Juneau sample only the .3 age group displayed any significant differences for both years of the study (Tables 6 and 7). Analysis by the use of the extension of multiple range test (Kramer 1956, and Duncan 1955) showed that in 1961 the .3 age fish had a greater mean length in May than during the succeeding three months which was significant at the .05 significance level (Table 8). In 1960 the May group was also significantly larger than the June and July fish but did not show any significant differences when compared to the August fish lengths.

The other two age groups tested (.2 and .4) did not display any significant differences between mean lengths by month in 1961 and showed inconsistent differences in 1960.

The larger .3 year fish found in May over the succeeding months probably means that a good percentage of these May fish were of the larger sexually mature fish on the way to local spawning grounds.

Length Frequencies by Age Group

The length frequency graphs for the different salt water age groups displayed a great deal of overlap (Figure 1). This fact, in addition to the number of peaks that occurred, was probably an indication of the many races and different growth rates that entered into the fishery.

In comparing the years 1960 and 1961 it was apparent that the .2 age fish suffered the greatest decline in abundance in 1961.

Age Composition of Salmon Derby King Salmon

The different time of year in which the Juneau and Ketchikan salmon derbies were held resulted in a harvest of kings in different stages of maturity.

The Juneau derbies were held in late July and early August. This resulted in a harvest of king salmon consisting mostly of .2 and .3 aged immature or "feeder" kings (Table 9). In contrast the Ketchikan derbies that were held in early June resulted in a harvest of a larger percentage of the .3 and .4 aged salmon on their way to the spawning grounds.

The average age composition of kings caught during the Juneau derbies[1] consisted of .2 age (34%), .3 age (60%) and .4 age (6%). The Ketchikan derbies showed an average age composition of .2 age (24%), .3 age (51%) and .4 age (25%).

[1] A more detailed account of the Salmon Derbies is given by Finger and Armstrong. 1965. Fishery and Biological Aspects of the Southeastern Alaska Salmon Derbies for 1959, 1960 and 1961. Alaska Department of Fish and Game Informational Leaflet No. 53.

TABLE 6. MEAN LENGTH BY MONTH AND OCEAN AGE CLASS FOR THE JUNEAU AREA IN 1960.

Age	Mean Length in centimeters ($\bar{X}$)	95% confidence interval	No. of Fish
2 yr. Ocean			
May	65.88	$62.91<\bar{X}<68.85$	17
June	64.32	$62.19<\bar{X}<66.45$	48
July	65.92	$64.75<\bar{X}<67.09$	106
August	67.17	$66.02<\bar{X}<68.32$	120
Average	65.82		
3 yr. Ocean			
May	82.57	$80.07<\bar{X}<85.07$	38
June	78.58	$76.92<\bar{X}<80.24$	132
July	78.47	$77.03<\bar{X}<79.91$	134
August	83.10	$81.42<\bar{X}<84.78$	75
Average	80.68		
4 yr. Ocean			
May	95.64	$93.76<\bar{X}<97.52$	66
June	96.02	$93.01<\bar{X}<99.03$	44
July	89.39	$85.76<\bar{X}<93.02$	32
August	93.00	$87.47<\bar{X}<98.53$	5
Average	93.51		

TABLE 7. MEAN LENGTH BY MONTH AND OCEAN AGE CLASS FOR THE JUNEAU AREA IN 1961.

Age	Mean Length in centimeters ($\bar{X}$)	95% confidence interval	No. of Fish
2 yr. Ocean			
May	65.50	$55.27<\bar{X}<75.73$	5
June	64.25	$61.60<\bar{X}<66.90$	20
July	67.03	$63.17<\bar{X}<70.89$	59
August	67.02	$65.15<\bar{X}<68.89$	26
Average	65.95		
3 yr. Ocean			
May	85.92	$83.42<\bar{X}<88.42$	65
June	76.70	$75.24<\bar{X}<78.16$	113
July	77.33	$75.92<\bar{X}<78.74$	131
August	77.21	$74.78<\bar{X}<79.64$	26
Average	79.29		
4 yr. Ocean			
May	92.97	$89.56<\bar{X}<96.38$	45
June	92.87	$85.08<\bar{X}<100.66$	34
July	94.44	$91.14<\bar{X}<97.74$	9
August	90.00	$76.23<\bar{X}<103.77$	4
Average	92.56		

TABLE 8. SUMMARY OF FISH LENGTH BY MONTH FOR THE DIFFERENT AGE GROUPS*

AGE	1960	1961
.2	June > August	No difference
.3	May > June May > July August > June August > July	May > June May > July May > August
.4	May > July June > July June > August	No difference

* Test of significance was Duncan's Multiple range and multiple F tests as extended by Kramer for unequal numbers of replications. Tested at the .05 level of significance.

FIGURE 1. LENGTH FREQUENCY BY AGE GROUPS FOR THE COMBINED JUNEAU AREAS.

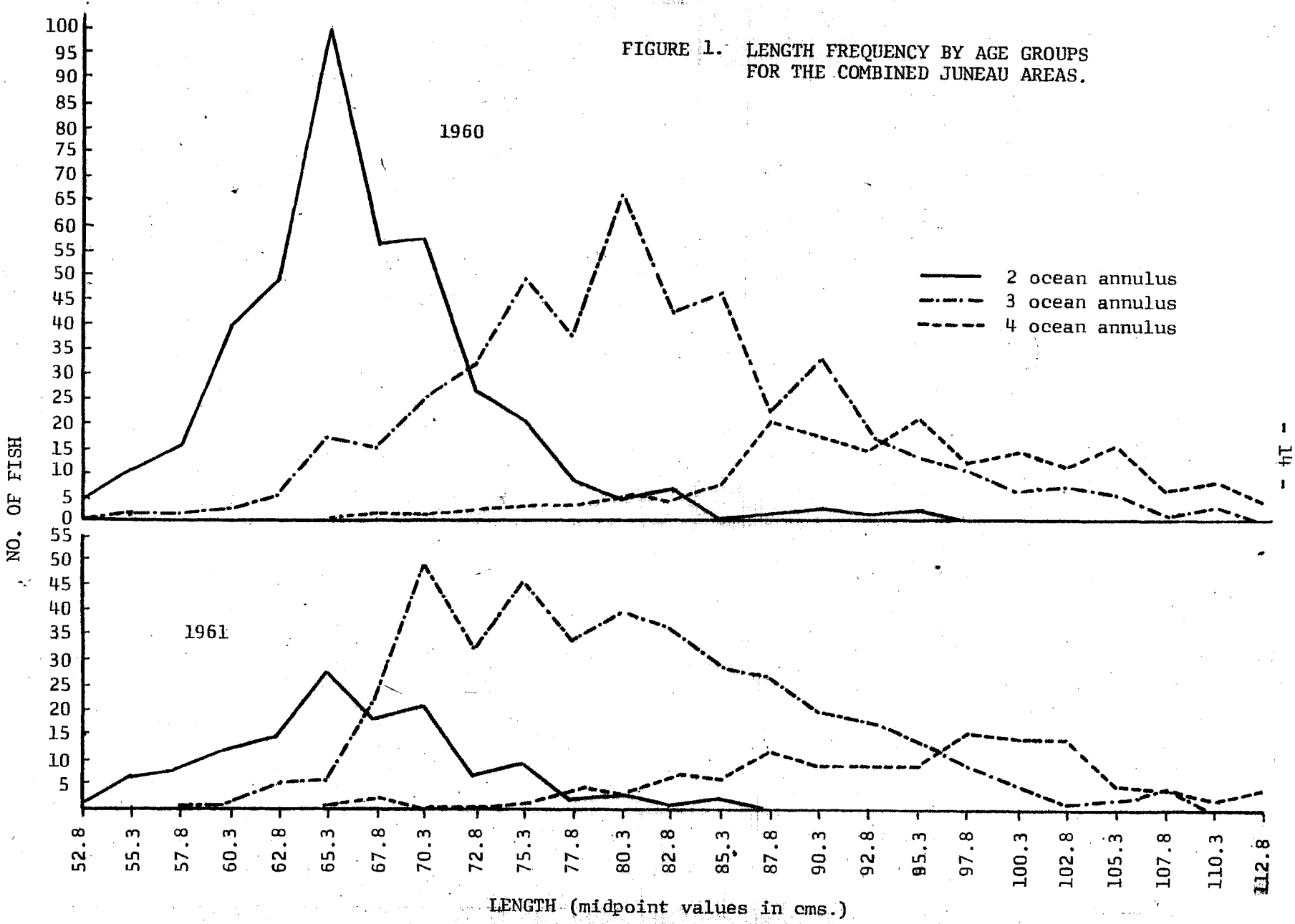

TABLE 9. OCEAN AGE COMPOSITION OF SALMON DERBY KING SALMON

Derby	Ocean Age						
	.2		.3		.4		Total
	No. Fish	%	No. Fish	%	No. Fish	%	No. Fish
Juneau Derby 1959 (July 24, 25, 26)	74	27	169	63	26	10	269
Juneau Derby 1960 (July 29, 30, 31)	133	44	159	52	12	4	304
Juneau Derby 1961 (August 4, 5, 6)	17	20	64	76	3	4	84
Ketchikan Derby 1960 (June 4, 5, 11, 12)	29	25	54	46	34	29	117
Ketchikan Derby 1961 (June 3, 4, 10, 11)	6	21	21	72	2	7	29

SUMMARY

1. King salmon which have spent three years in saltwater were the age group most frequently caught by sport fishermen.

2. As the season progressed the .2 aged kings (feeders) were more frequently caught while the .4 aged salmon decreased in numbers. This showed that the mature fish arrived early in the spring and as the season progressed the immature or "feeder" kings arrived in increasing numbers.

3. The high percentage of male king salmon in the .2 age group, that are caught in May, probably indicated that this group consisted mostly of precocious male kings (jacks) that were on their spawning run. If a large percentage of the .2 age males returned to the rivers to spawn, this may be the reason for the higher percentage of .2 old females which entered into the catch later in the year and also the greater female abundance of .3 and .4 age groups later in the season.

4. The mean length of the white fleshed king salmon was greater than the mean length of the red fleshed king salmon in the .2 and .3 age groups, but the reason for this was not apparent. There appeared to be no sex differences in regards to flesh color except for the single exception in that the .3 age white females were larger than the red females.

5. The mean length of the .3 age group was greater in the month of May than the succeeding two to three months. This probably indicated that a fair percentage of these fish caught in May were of the larger sexually mature king salmon.

6. All of the above age comparisons were indicative of the many variations of king salmon stocks which enter into the Southeastern Alaska sport fishery. The complex life cycle of the king salmon and the many races which were probably harvested resulted in difficulty in separating the various age dependent variables in the king salmon sport fishery.

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